

GPAT4, GPAT6, and GPAT8 are required for suberin deposition in roots of Arabidopsis seedlings with non-redundant functions to GPAT5 and GPAT7

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A family of closely related land plant-specific glycerol-3-phosphate acyltransferases (GPATs) play a key role in the precursor synthesis of cutin and suberin strengthening the diffusion barrier properties of cell walls in specific cell types. GPATs have an acyltransferase and a phosphatase domain, although the site conferring phosphatase activity is only conserved in the GPAT4/6/8-clade that had been associated with cutin formation up to now. Arabidopsis *gpat4 gpat6 gpat8* triple mutant seedlings forming suberin in the endodermis exhibit a 75% reduction in the suberin polyester, affecting aliphatic monomers of all chain lengths as well as of ferulate. In contrast, the *gpat5 gpat7* double mutant seedlings exhibit a 50% reduction in suberin, affecting only aliphatic monomers, predominantly of C18-C24 in length. In the *gpat4 gpat6 gpat8* mutant endodermal suberin forms a continuous layer that is partially detached from the cell wall. In contrast, in the *gpat5 gpat7* mutant amorphous globular polyester deposits are formed in the apoplast that are not integrated into a lamellae structure despite the normal amounts of ester-bound hydroxycinnamic acids. While the phosphatase domain of GPAT4, GPAT6 and GPAT8 is required for high level suberin deposition, different lines of evidence suggest that the loss of phosphatase is essential for the formation of well-structured suberin lamellae. Thus, during evolution the accumulation of mutations in the phosphatase domain might have been central for the formation of suberin having specialized functions.